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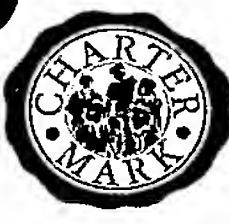
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GB0403648.9

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Description 9

Claim(s) 2

Abstract 1

Drawing(s) 3A

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Priority documents

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Statement of inventorship and right to grant of a patent (Patents Form 7/77)

Request for a preliminary examination and search (Patents Form 9/77)

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ip21 Ltd., by P. Wilson

Date 18/02/2004

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DUPPLICATE

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10 - 1 -

A MEDICAL SLEEVE

Field of the Invention

15

The invention relates to a device to assist the application of preparations such as antimicrobial agents, medicaments and cosmetics to the surface of a user's limb. The device is particularly suitable to assist in decontamination of limbs prior to surgery thereon.

20

Background to the Invention and Prior Art known to the Applicant

25 The decontamination and sterilisation of skin is one of the most important parts of any surgical operation. Since the work of Pasteur, Lister, Semmelweiss and others, we have known that bacteria cause infection. As a consequence of their work, a variety of methods are now routinely used to reduce the bacterial count on the surface of the skin prior to surgical procedures.

30 Standard techniques employed to this end include: skin depilation (i.e. removal of hair) immediately prior to surgery; removal of any visible contamination; washing of the skin with soap and water; painting of the skin with an anti-microbial agent.

This last part of the preparation before surgery (i.e. the use of an anti-microbial agent) is often known amongst surgeons as the 'skin prep'. It is this procedure that has turned surgery from a life-threatening procedure into the safe procedure it is today. Prior to the introduction of skin prep, mortality rates from wound infection could be as high as 40%.

5 Following the introduction of skin preparation, the infection rate from bacteria residing on the skin has fallen to almost unrecordable levels.

However, the introduction of more complex surgery, and especially joint-replacement surgery, where the presence of foreign material in the body potentiates the infection, has

10 led to a reassessment of skin preparation.

It is known that anti-microbial agents such as iodine, chlorhexidine and alcohol need time in contact with the skin to kill the bacteria. It is also known that there is a reservoir of skin-associated organisms that reside in the sweat glands and hair follicles of the body.

15 Therefore, a skin preparation agent that stays on the skin for a period of time prior to surgery will be more effective in reducing the bacterial count. Furthermore, if the agent forms a film on the skin which is retained throughout the operation, then this is also of benefit.

20 A common technique for application of the anti-microbial agent is as follows: the surgeon or the surgeon's assistant is supplied with a bowl containing the skin preparation fluid, and something for applying the agent. This usually comprises a swab or a piece of sponge held in a pair of locking forceps. For preparation of the abdomen or chest, this is usually excellent. The area to be cleaned is roughly flat, does not need to be moved, and is

25 clearly visible to the surgeon.

For structures such as the arm and leg, the situation is more difficult. As the skin prep is carried out after anaesthesia has commenced, the limb must be held in the air by an assistant. It is not possible to clearly see the entire surface of limb. In particular, toes and

30 fingers are difficult to prepare. The person who holds the limb is 'non-sterile' – i.e. has not been through the de-contamination procedures carried out by surgeons and their assistants – and so has to transfer the support of the limb to the sterile surgical team. This whole procedure takes a significant amount of time and can be prone to contamination. If

a tourniquet is being used, then the anti-microbial agent can seep under the tourniquet and cause contact burns.

Whilst lifting of an arm is not too difficult, lower limbs have considerable weight and 5 may have to be supported whilst the limb is cleaned. As a result, the non-sterile member of the team initially supporting the limb may have to support it at arm's length to allow the surgical team access to the limb. This can be dangerous, not only for the patient, if the leg is dropped, but also to the person holding the limb, and can result in back strain and other similar injuries.

10 Whilst these problems, and the solutions provided by the current invention, are described in terms of human surgical procedures, they clearly have parallels in the veterinary field.

Furthermore, whilst the invention relates primarily to problems associated with the 15 application of anti-microbial agents to limbs, there are similar problems in associated areas for which the invention has considerable application. For example, it is often required to apply other agents such as medicaments, depilants (hair-removal agents) and cosmetic preparations such as artificial tanning solutions to limbs of users, without undue contact of the agent with the hand of the person applying it. Furthermore, these agents 20 may need to be left in contact with the skin for some length of time without the agent drying or coming into contact with, for example, clothes, furniture or other parts of the body.

The invention also has application as temporary wound-dressing, for example in the 25 treatment of burns, and allows wound inspection following surgery or during ward rounds.

It is an object of the present invention to attempt a solution to these problems.

30 Summary of the Invention

The invention provides a device adapted to assist the sterilisation of a limb surface, and comprising: a flexible tubular sleeve, closed at one end, shaped and sized so as to loosely

fit, in use, around the limb of a patient whose limb surface is to be sterilised; and respective limb-sealing means, each located close to or at a respective end of said sleeve, and each capable of forming, in use, a seal between the sleeve and the limb of a patient.

5 Preferably, at least one of the limb-sealing means comprises a perforated, elastic diaphragm. This type of limb-sealing means has a particular advantage over eg. a simple drawstring arrangement or elasticated cuff in that the elastic diaphragm can stretch to accommodate the varying diameters of a patient's limb without either the need to adjust the drawstring, or the possibility of an ineffective seal between an elasticated cuff and a
10 patient's limb.

In any embodiment of the invention it is also preferable that at least one of the limb-sealing means comprises a substantially frustoconical portion. Not only can this arrangement assist in the insertion of a patient's limb into the limb-sealing means, but it
15 may also be used to position the limb-sealing means, before use, away from contamination.

In any aspect of the invention, the limb-sealing means are preferably constructed so as to create a wiping action when slid, in use, along a patient's limb. This feature is
20 particularly advantageous as it serves to remove any excess fluid that has been applied to a patient's limb before the commencement of surgery.

In any aspect of the invention, both ends of the said sleeve are advantageously initially closed. By closing both ends of the sleeve, it is possible to produce the device in a sterile
25 fashion and to maintain that sterility during storage.

In any aspect of the invention, the sleeve of the device is preferably substantially transparent. By this means, it is possible for an operator or a user to see the limb whilst applying fluid such as an anti-microbial formulation. This enables the user to ensure that
30 the fluid is spread evenly over the limb and reaches all exposed parts, such as between the fingers and toes.

In any aspect of the invention, it is preferable that at least one of any sealed end of the sleeve is perforated, nicked, weakened or otherwise adapted to assist opening of that sealed end. In the surgical context, it is advantageous to be able to open an end of the sleeve quickly and without use of cutting means such as scissors or a scalpel. This avoids 5 risk of injury to the patient and contamination of surgical or other instruments.

In any aspect of the invention, it is advantageous that the device further comprises at least one tab or loop to assist pulling the sleeve, in use, along a patient's limb. When used in the field of pre-surgical limb sterilisation, it is important not to re-introduce any 10 contamination onto the patient's limb following the 'skin prep'. By providing tabs or loops, especially at the end closest to the extremity of the limb, a surgeon or surgeon's assistant can pull the sleeve along the limb and avoiding contact with the sterilised skin surface. As well as flexible tabs or loops, such a loop could advantageously comprise a rigid ring, large enough to pass over a patient's limb, to facilitate pulling the sleeve along 15 the limb. Such means to assist pulling the sleeve may be advantageously located at either or both ends of the sleeve to assist the two pulling actions envisaged: firstly to pull a first end over the limb to enclose it; and secondly to pull the send end up to meet the first end, thereby exposing the treated skin.

20 In any aspect of the invention, it is advantageous for the device to further comprise fastening means to hold the two ends of the sleeve close together whilst the sleeve is positioned on a patient's limb. In use, and as illustrated and described below, the two ends of the sleeve may be brought together on a patient's limb causing the sleeve to adopt a bunched configuration. Provision of fastening means, such as adhesive tape, a stud type 25 fastening or even a simple tie fastening allows the operator to maintain the sleeve in that configuration without it slipping back down the patient's limb.

In any aspect of the invention, it is preferable that the device has an easily rupturable container of sterilising agent inside (in use) the sleeve. It is particularly advantageous to 30 provide such a container within the sleeve as it will remove the need for an operator to have contact with the sterilising agent (or other medicament or cosmetic preparation) during the application process. Furthermore, this allows a pre-metered dose of sterilising agent to be provided thus ensuring that sufficient material is used.

In any aspect of the invention, it is advantageous that the sleeve further comprises a valve arrangement to allow egress of air from within the sleeve whilst the sleeve is positioned on a patient's limb. In one such aspect, the valve would be a on-way valve, to allow air to escape from between the patient's limb and the sleeve, in use, so facilitating e.g. moving both ends of the sleeve to a common point on the limb (to expose the skin surface) without the sleeve "ballooning" due to trapped air. In another such aspect, the valve arrangement would comprise a simple tap arrangement to allow air to escape from, or to be introduced into the sleeve. For situations requiring aseptic conditions, the valve arrangement may be provided with a air filter suitable for removing airborne contaminants such as bacteria. In this arrangement, therefore, the sleeve may be inflated or deflated at will. In this way, the relative proximity of the sleeve and the patient's skin may be controlled: by inflating the sleeve, it is held away from the skin, allowing improved inspection of e.g. wounds; by deflating the sleeve, it may be repositioned more easily, and may be used to apply pressure to the patient's limb, or to dressings or medicaments applied thereon.

Included within the scope of the invention is a device substantially as described herein with reference to and as illustrated by any appropriate combination of the accompanying drawings.

Brief Description of the Drawings

The invention will be described with reference to the accompanying drawings in which:

25

Figure 1 is a schematic plan view of the device.

Figure 2 and Figure 3 are schematic diagrams illustrating the construction of a frustoconical, perforated, elastic diaphragm suitable for use as a limb-sealing means.

30

Figure 4 is a schematic diagram illustrating the insertion of a limb-sealing means within a sleeve.

Figure 5 is a schematic diagram of an embodiment of the invention incorporating frustoconical limb-sealing means, loops to assist pulling of the sleeve and a container of sterilising fluid.

5 Figure 6 illustrates the embodiment of Figure 5 with the limb-sealing means everted.

Figure 7 illustrates an embodiment of the invention with fastening means.

Figures 8 to 12 illustrate an embodiment of the invention in use, on a patient's arm.

10

Embodiments of the Invention

Figure 1 is a schematic plan of the device, shown generally as 1, comprising a flexible tubular sleeve 2 made of a flexible, transparent, plastics material. The sleeve is closed at 15 one end 3 and open at the other end 4. Close to each end of the sleeve there is a limb-sealing means comprising a drawstring 6 located within a channel 5, which surrounds the sleeve 2. The sleeve 2 fits loosely around the limb of a patient and each of the limb-sealing means may be operated by means of the drawstrings 6 to form a seal, in use, between the sleeve 2 and the limb of a patient.

20

Figures 2 and 3 illustrate a design for an embodiment of the limb-sealing means, comprising a perforated, elastic diaphragm. Figure 2 illustrates a sheet of elastic material 7, such as rubber, which has a hole 8 in the centre. The dashed line 9 indicates where to fold the sheet 7, and the dashed lines 10 illustrate where to subsequently seal and trim the 25 sheet 7. Figure 3 illustrates a plan view of the folded, sealed and trimmed sheet 7 forming a frustoconical limb-sealing means, generally indicated as 11, with a hole 8.

Figure 4 illustrates a way in which a limb-sealing means may be incorporated into a sleeve. There is illustrated, in part, a sleeve 2 with a sealed end 3. Such a sleeve may 30 conveniently be manufactured from a heat-sealable plastics material. Located within the sleeve is a frustoconical member 12 of a similar plastics material that may be heat-sealed to the sleeve around its periphery, indicated generally by 13. At the smaller end of this

member 12 is located a limb-sealing means 11 (as illustrated in Figure 3) which may be sealed to the frustoconical member 12 where they meet, generally indicated by 14.

Figure 5 illustrates another, preferred, embodiment of the invention, generally indicated as 15. The device comprises a flexible, transparent sleeve 2 with a closed end 3 and an open end 4. Located at the closed end 4 is a limb-sealing means 11 of the frustoconical, elastic diaphragm type as discussed above. A second limb-sealing means 11 is located toward the sealed end 3 of the sleeve 2. The sealed end 3 is weakened, by perforation 16, to assist opening of the sealed end 3. The device further comprises loops 17 attached to the sleeve 2 and close to the initially sealed end 3.

Figure 6 illustrates the embodiment of Figure 5 in which the frustoconical limb-sealing means 11 are shown in their everted configuration, after having opened the initially sealed end 3 and pulled the sleeve 2 over the limb of a patient (not shown) in a left to right direction in the illustration.

Figure 7 illustrates an embodiment of the invention further comprising fastening means 18 attached to the sleeve 2. In this embodiment, the fastening means 18 comprise self-adhesive tags, attached to the sleeve 2, each having a peel-off protective strip 19 over the adhesive. In this embodiment, three such tags are provided. The second limb-sealing means of this embodiment is not illustrated in Figure 7 for sake of clarity. Also illustrated in Figure 7 is a valve arrangement 27 to allow control of air movement in and out of the sleeve when it is positioned on a patient's limb.

25 Use of the Device

Figures 8 to 12 illustrate an embodiment of the device in use on the arm of a patient.

Figure 8 illustrates an embodiment of the device 20 in position around the arm 21 of a patient. The arm passes through the first limb-sealing means 22 into the interior of the sleeve 2. The second limb-sealing means 23 is, at this stage, not surrounding the arm 21. Within the sleeve 2 is located a sachet of skin-sterilisation fluid 24.

In Figure 9, the sachet 24 has been opened to release its contents 25 which now be spread over the surface of the arm 21. This process may be carried out by, or with the assistance of the patient, or by the surgeon's assistant alone. The transparent nature of the sleeve 2 enables the fluid to be seen and helps to ensure that it is spread over the entire surface, especially between the fingers 26.

Figure 10 illustrates the stage where the arm of the patient 21 has been pushed through the second sealing means 23 into the space between that sealing means 23 and the sealed end 3 of the sleeve 2. The spent sachet 24 of sterilising fluid has also been passed into this section of the sleeve 2 ready for disposal.

The patient may be conveniently anaesthetised at this stage.

Figure 11 illustrates the stage when the initially sealed end 3 has been opened by means of perforations 16 (illustrated in Figure 10), leaving a now open end 25. In this state, the sleeve 2 will adopt a generally bunched configuration 26.

Figure 12 illustrates the final situation where the sleeve 2 has been pulled up to the top of the arm 21, thus exposing the sterile skin ready for surgery. In this configuration, the sleeve 2 is in its bunched configuration 26 and the two limb-sealing means, 22 and 23, are close together. It is at this stage that the fastening means (not illustrated) are particularly useful in maintaining the sleeve 2 in this configuration. The wiping action of the limb-sealing means 23 when pulled from its position shown in Figure 11 to that shown in Figure 12 removes excess sterilising fluid from the surface of the arm 21.

25

The operation may now commence. At this stage, or after surgery, the whole device may be removed from the patient's arm by cutting and can be disposed with.

CLAIMS

1. A device adapted to assist the sterilisation of a limb surface, and comprising:
 - 5 a flexible tubular sleeve, closed at one end, shaped and sized so as to loosely fit, in use, around the limb of a patient whose limb surface is to be sterilised; and respective limb-sealing means, each located close to or at a respective end of said sleeve, and each capable of forming, in use, a seal between the sleeve and the limb of a patient.
 - 10 2. The device of claim 1 wherein at least one of the limb-sealing means comprises a perforated, elastic diaphragm.
 3. The device of any preceding claim wherein at least one of the limb-sealing means comprises a substantially frustoconical portion.
 - 15 4. The device of any preceding claim wherein the limb-sealing means are so constructed as to create a wiping action when slid, in use, along a patient's limb.
 5. The device of any preceding claim wherein both ends of the said sleeve are initially closed.
 - 20 6. The device of any preceding claim wherein the sleeve is substantially transparent.
 7. The device of any preceding claim wherein at least one of any sealed end of the sleeve is perforated, nicked, weakened, or otherwise adapted to assist opening of that sealed end.
 - 25 8. The device of any preceding claim further comprising at least one tab or loop to assist pulling the sleeve, in use, along a patient's limb.
 - 30 9. The device of any preceding claim further comprising fastening means to hold the two ends of the sleeve close to each other, whilst the sleeve is positioned on a patient's limb.

10. The device of any preceding claim with an easily rupturable container of sterilising agent inside (in use) the sleeve.

11. The device of any preceding claim further comprising a valve arrangement to allow
5 egress of air from within the sleeve whilst the sleeve is positioned on a patient's limb.

12. A device substantially as described herein with reference to and as illustrated by any appropriate combination of the accompanying drawings.

ABSTRACTA MEDICAL SLEEVE

5 The invention provides a device adapted to assist the sterilisation of a limb surface, comprising a flexible tubular sleeve, closed at one end, shaped and sized so as to loosely fit, in use, around the limb of a patient whose limb surface is to be sterilised. The sleeve has limb-sealing means, located close to or at each end of the sleeve, and each capable of forming, in use, a seal between the sleeve and the limb of a patient. The device is
10 particularly suitable to assist in de-contamination of limbs prior to surgery thereon.

Figure 9 should accompany the abstract.

1/3

Figure 1

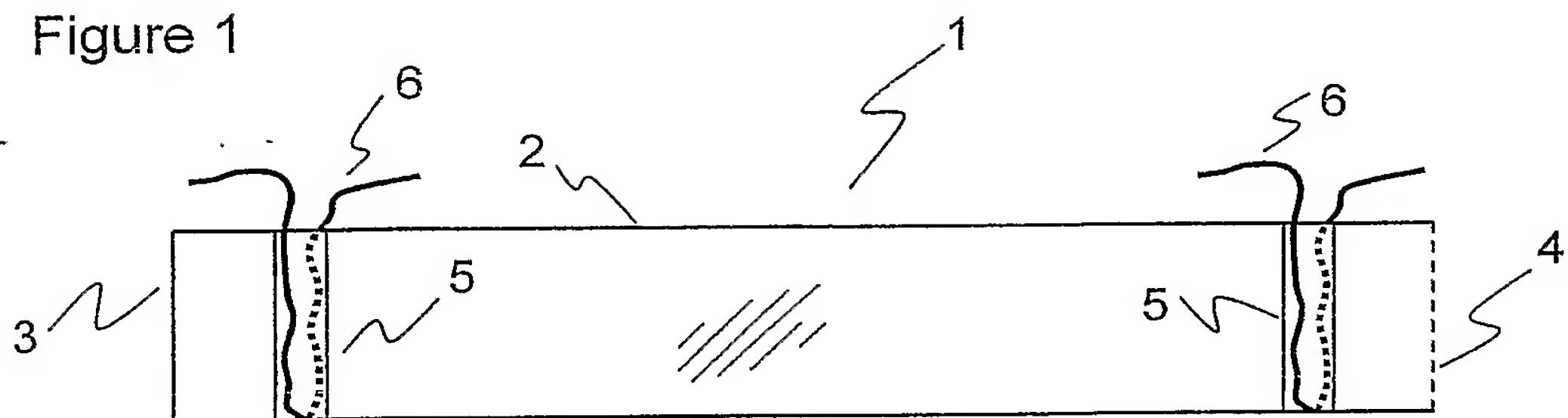


Figure 2

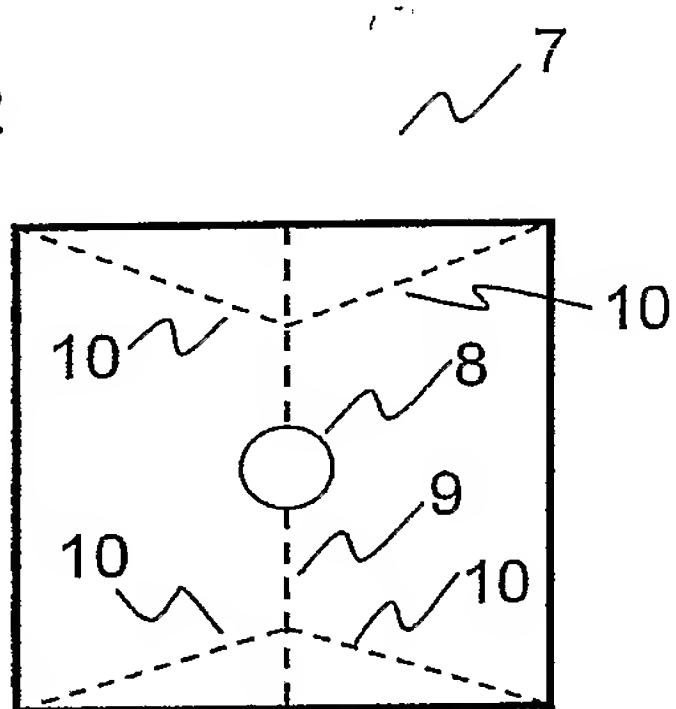


Figure 3

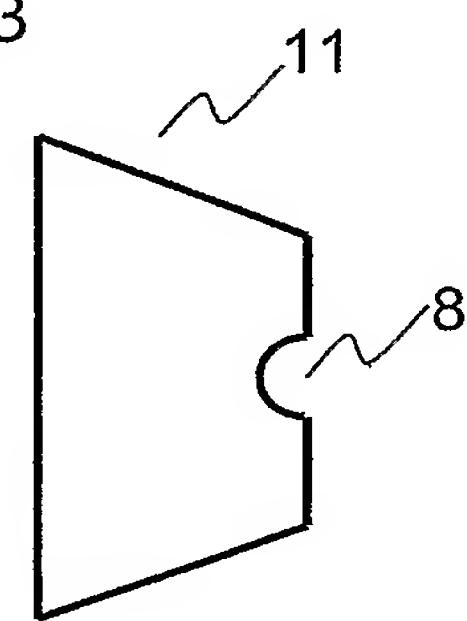
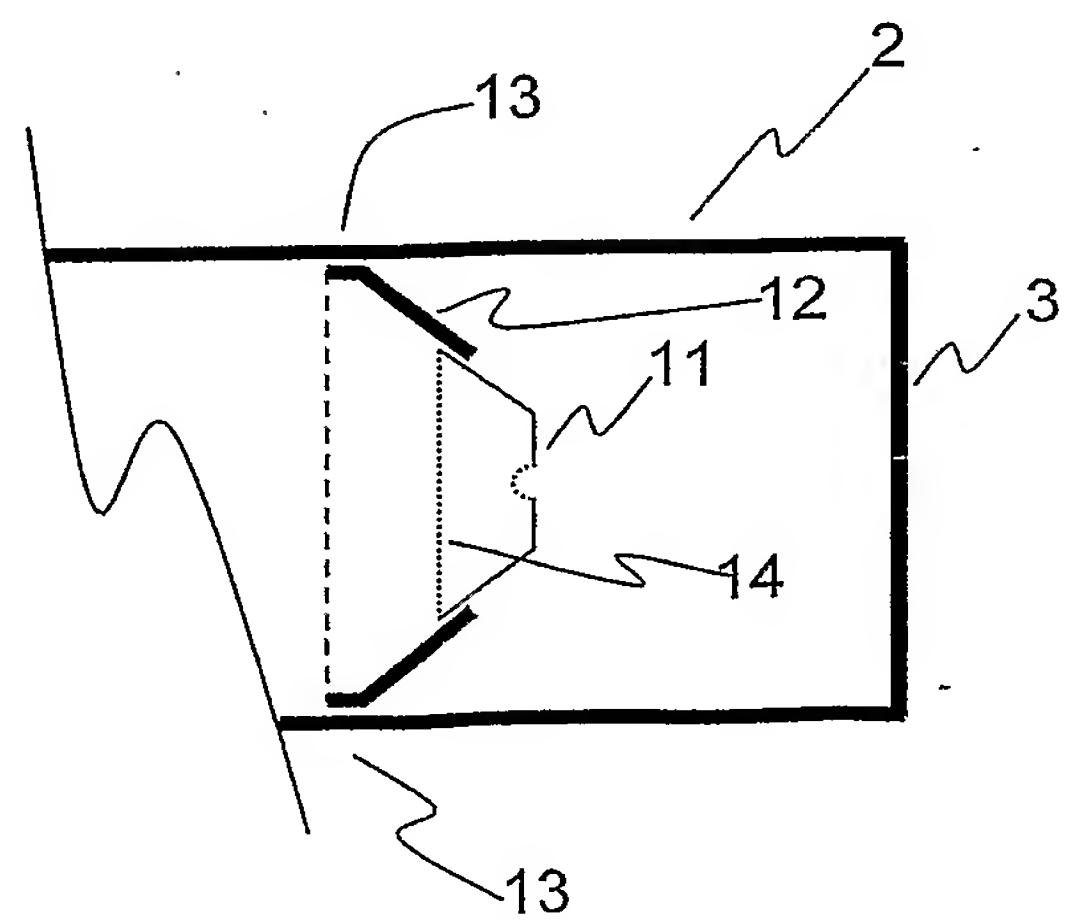


Figure 4



2/3

Figure 5

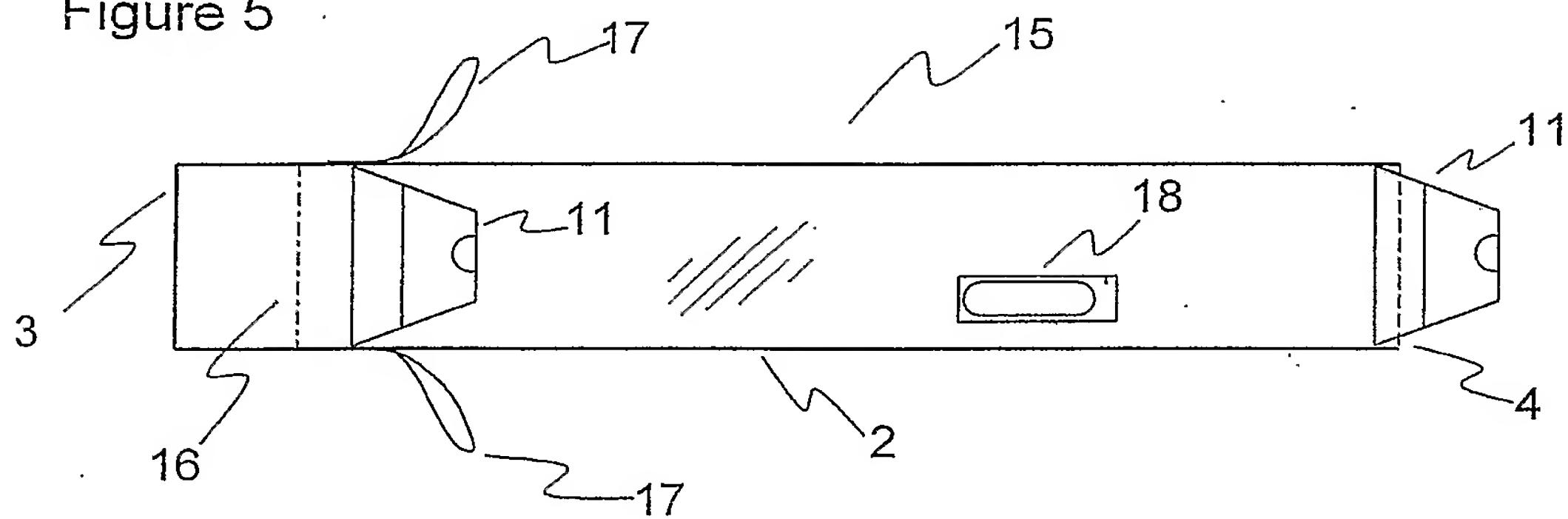


Figure 6

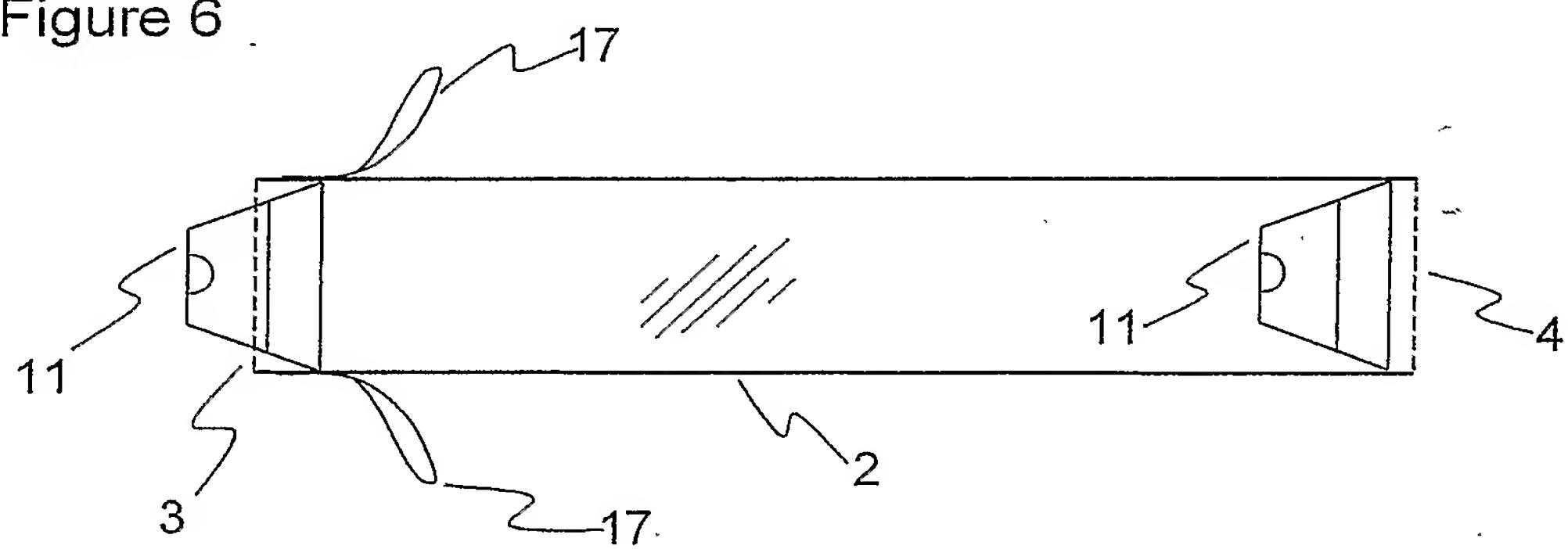
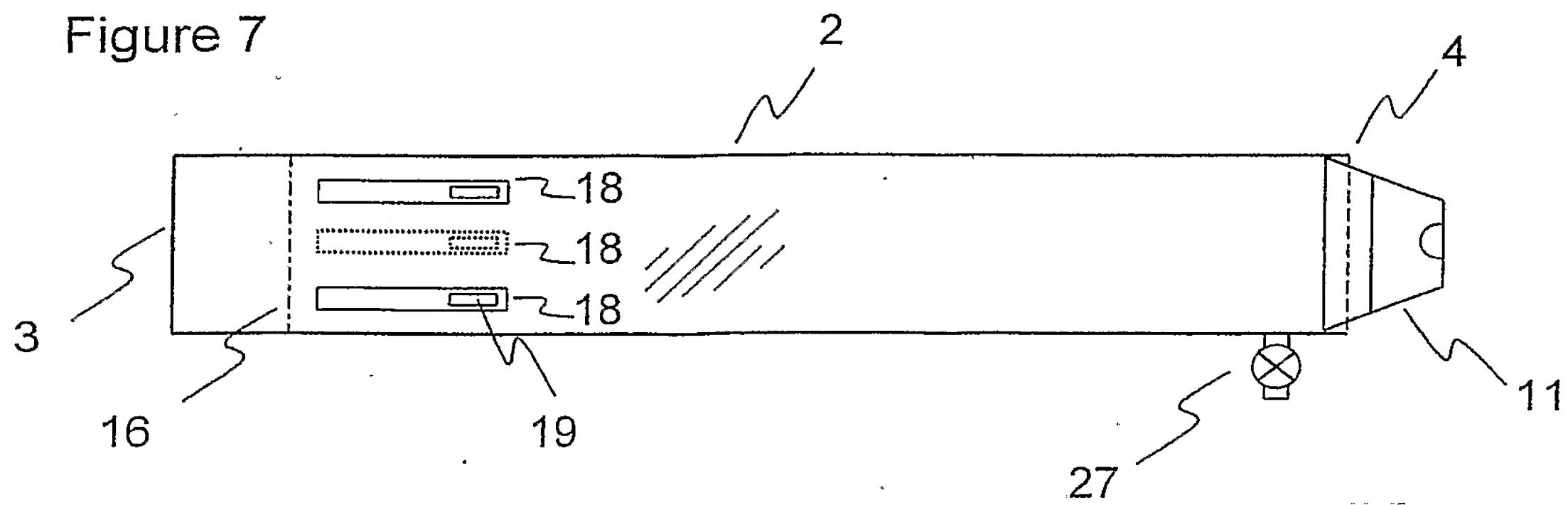


Figure 7



3/3

Figure 8

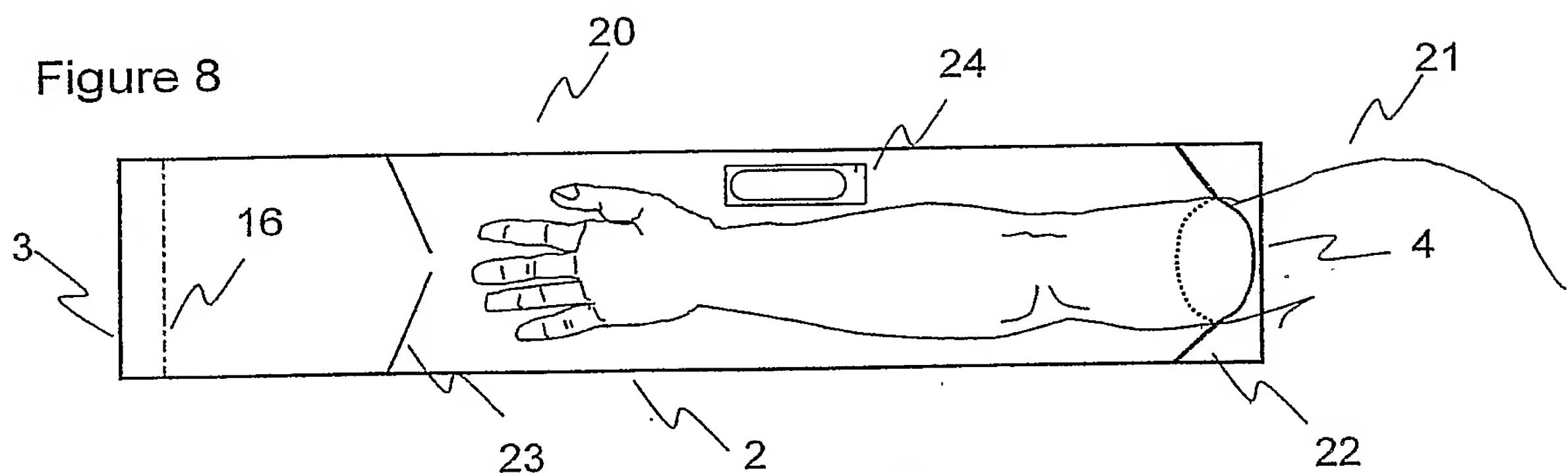


Figure 9

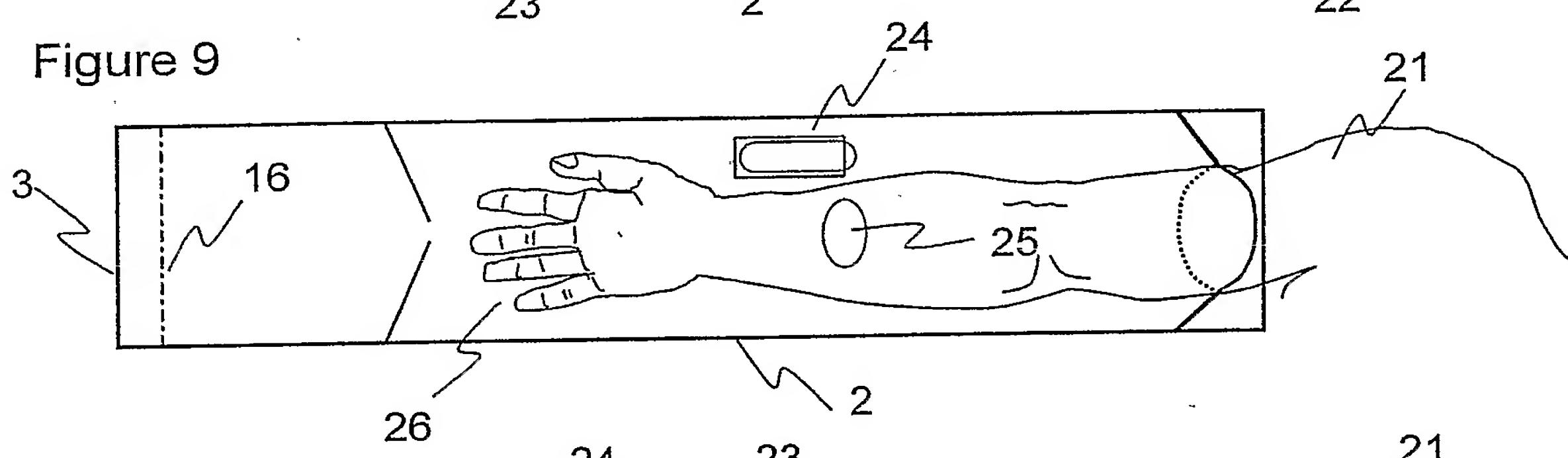


Figure 10

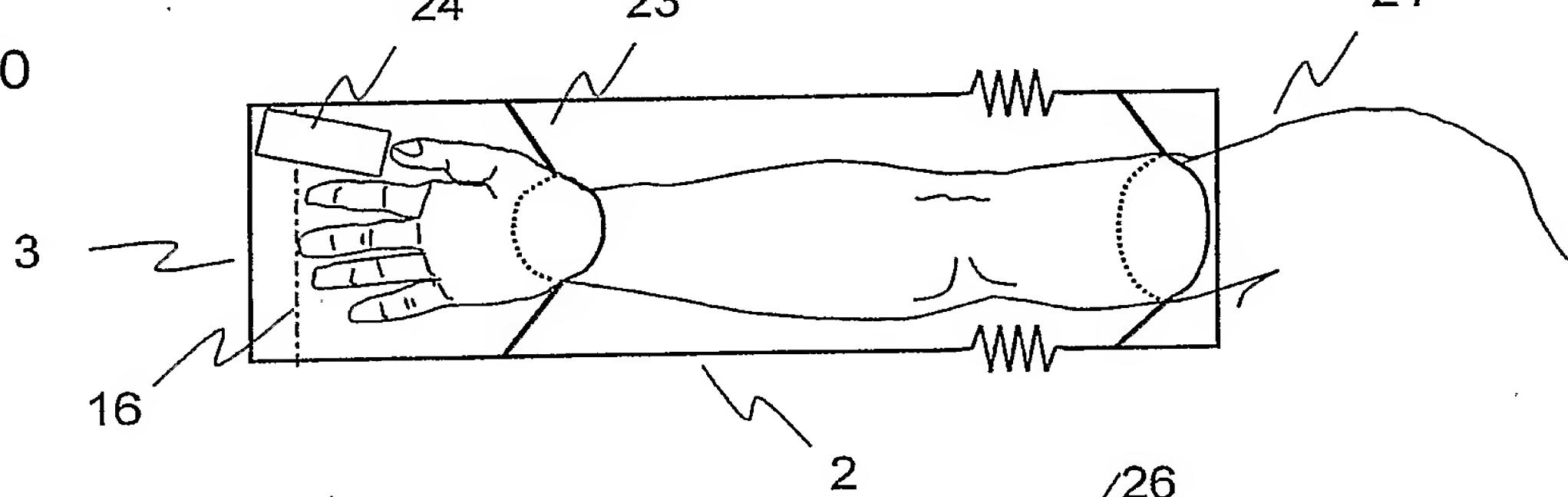


Figure 11

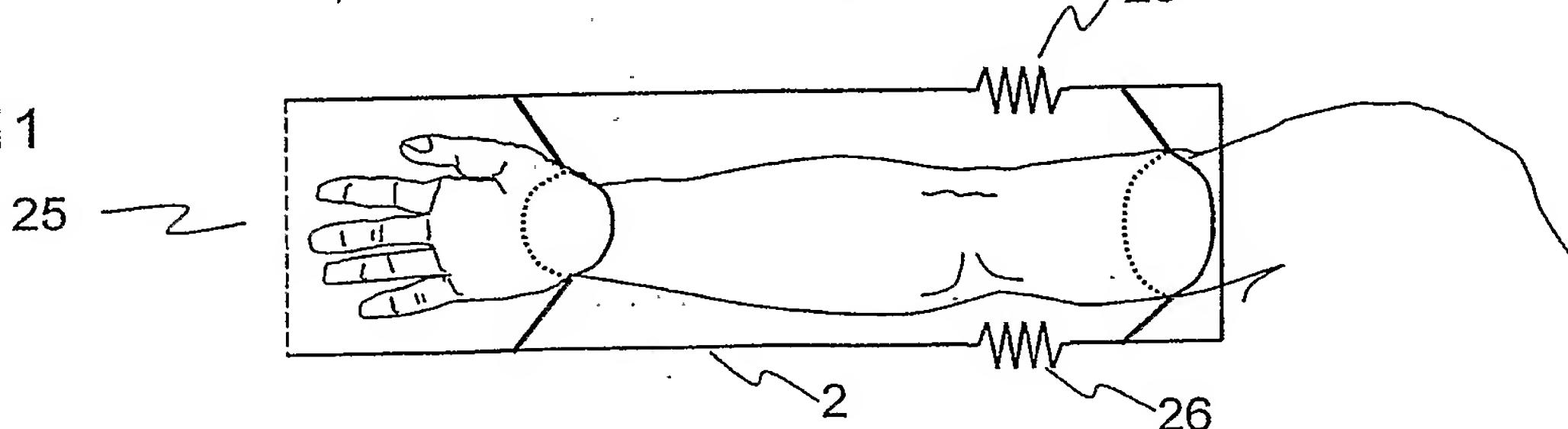


Figure 12

